In the Claims:

All pending claims are reproduced below for the convenience of the Examiner. Claims which have been changed by this amendment are indicated as "amended."

74. An apparatus for interfacing the motion of a user-manipulable object with a host computer, the apparatus comprising:

a linkage mechanism providing two degrees of freedom to an object engaged with said linkage mechanism about two axes of rotation, said linkage mechanism including at least two members rotatably coupled to each other;

an actuator for generating a force in one of said degrees of freedom of said linkage mechanism; and

a friction drive mechanism coupled between said actuator and said linkage mechanism, wherein said force from said actuator is transmitted to said linkage mechanism through frictional contact of a plurality of members of said friction drive mechanism, wherein said members include a drive roller and a moveable member having a rigid portion in frictional contact with said drive roller.

75. An apparatus as recited in claim 74 wherein said moveable member includes a rotatable drum and said rigid portion is at least a portion of a drive bar, and wherein said members of said fiction drive mechanism include said drive bar and a drive roller coupled to said actuator, said drive roller frictionally engaging said drive bar to rotate said drum and transmit a force to said object in said first degree of freedom.

76. An apparatus as recited in claim 75 wherein said drive bar only tangentially contacts a circumferential surface of said drive roller.

77. (amended) An apparatus as recited in claim 74 further comprising a second degree of freedom actuator coupled to said [gimbal] linkage mechanism to generate a force along said second degree of freedom, wherein said first degree of freedom actuator and said second degree of freedom actuator are coupled to a ground member of said linkage mechanism, and further comprising an additional friction drive mechanism coupled between said second degree of freedom actuator and said linkage mechanism to transmit a force from said second degree of freedom actuator to said object in said second degree of freedom.

78. An apparatus as recited in claim 75 further comprising a passive roller frictionally engaged with said drive bar on an opposite side of said drive bar to said drive roller.

79. An apparatus as recited in claim 74 wherein said linkage mechanism includes a closed loop five member linkage, wherein each of said five members is rotatably coupled to at least two other members of said linkage.

80. An apparatus as recited in claim 79 further comprising at least one sensor coupled to said apparatus to sense positions of said object along said two degrees of freedom and which produce electrical signals corresponding to such positions for said host computer.

81. An apparatus as recited in claim 75 wherein said object includes one of the groups consisting of at least a portion of a surgical tool, a stylus, and a joystick.

82. An apparatus as recited in claim 75 wherein said drive bar is curved such that said drive bar forms a portion of a circle having a radius of greater length than a radius of said drive roller.

10 ~~83~~. (amended) A force feedback interface device for interfacing the motion of a user with a host computer system, the force feedback interface device comprising:

a user manipulatable object physically contacted by a user and moveable by said user in at least one degree of freedom;

an actuator coupled to said user manipulatable object that applies a force [in said degree of freedom];

a sensor that detects motion of said user manipulatable object in said at least one degree of freedom and provides a sensor signal to said host computer system; and

a friction drive mechanism coupled between said actuator and said user manipulatable object, wherein force from said actuator is transmitted to said user manipulatable object through frictional contact of members of said friction drive mechanism, wherein said members of said friction drive mechanism include a drive roller and a drive bar in direct frictional contact with said drive roller, said drive roller coupled to and driven by said actuator, wherein force is applied to said drive bar by said actuator only through said frictional contact, and wherein said drive bar is curved such that said drive bar forms a portion of an arc having a radius of greater length than a radius of said drive roller.

11 ~~84~~. (amended) A force feedback interface device as recited in claim [82] 10 ~~83~~ further comprising a linkage mechanism coupled between said user manipulatable object and said friction drive mechanism, said linkage mechanism providing said at least one degree of freedom to said user manipulatable object.

Please cancel claim 85 without prejudice.

12 86. (amended) A force feedback interface device as recited in claim 84 11 wherein said drive bar [is at least partially curved and] is coupled to a rotating member, and wherein said frictional engagement rotates said rotating member.

Please cancel claim 87 without prejudice.

13 88. A force feedback interface device as recited in claim 84 11 further comprising a passive roller frictionally engaged with said drive bar on an opposite side of said drive bar to said drive roller.

89. A force feedback interface device as recited in claim 87 wherein said passive roller is spring biased toward said drive roller to create a clamping force between said drive roller and said drive bar.

90. A force feedback interface device as recited in claim 84 wherein said drive bar is flexible.

91. A force feedback interface device as recited in claim 84 wherein said drive bar is rigid.

18 92. (amended) A force feedback interface device as recited in claim [83] 84 11 wherein said linkage mechanism is a gimbal mechanism providing said at least one degree of freedom as a first degree of freedom and providing a second degree of freedom to said user manipulatable object, said user manipulatable object being coupled to said gimbal mechanism at about an intersection of two axes of rotation of said user manipulatable object.

19 93. (amended) A force feedback interface device as recited in claim 92 18 wherein said actuator is a first actuator that generates a force along said first degree of freedom, and further comprising a second actuator coupled to said gimbal mechanism to generate a force along said second degree of freedom, wherein said first [degree of freedom] actuator and said second [degree of freedom] actuator are coupled to a ground member of said gimbal mechanism, and further comprising an additional friction drive mechanism coupled between said second actuator and said gimbal mechanism to transmit a force from said second actuator to said user manipulatable object in said second degree of freedom.

20 94. (amended) A friction drive mechanism for use in a force feedback interface device that is coupled to a host computer system and which outputs force sensations to a user, the friction drive mechanism comprising:

a moving member movable in a rotary degree of freedom and providing a user manipulatable object with motion in said rotary degree of freedom, wherein said user manipulatable object is grasped by [a] said user;

a drive bar directly coupled to said moving member such that said drive bar moves in said rotary degree of freedom with said moving member; and

a drive roller frictionally engaged and in contact with said drive bar and operative to apply a force to said drive bar when rotated by [said] an actuator, wherein said force is transmitted to said moving member such that said force is applied in said rotary degree of freedom[; and]

[a passive roller frictionally engaged with said drive bar on an opposite side of said drive bar to said drive roller].

Please cancel claims 95 and 96 without prejudice.

97. (amended) A friction drive mechanism as recited in claim 94 further comprising a passive roller frictionally engaged with said drive bar on an opposite side of said drive bar to said drive roller, wherein said passive roller is spring biased toward said drive roller to create a clamping force between said drive roller and said passive roller on said drive bar.

98. (amended) A friction drive mechanism as recited in claim 97 further comprising a passive roller frictionally engaged with said drive bar on an opposite side of said drive bar to said drive roller, wherein said passive roller is a first passive roller, and further comprising a second passive roller frictionally engaged with said drive bar.

99. A friction drive mechanism as recited in claim 94 wherein said drive bar is flexible.

100. A friction drive mechanism as recited in claim 94 wherein said drive bar is rigid.

101. (amended) A method for producing a force on a user manipulatable object of a force feedback device coupled to a host computer, wherein a user physically contacts said user manipulatable object, the method comprising:

outputting a rotational force from an actuator to a drive roller;

frictionally engaging said drive roller with a drive bar, wherein said drive bar engages a circumferential surface of said drive roller approximately tangentially to said circumferential surface; and

transmitting said rotational force from said drive roller to said drive bar and from said drive bar to a user manipulatable object coupled to said drive bar, said user manipulatable object being physically contacted by a user of said force feedback device, wherein said drive bar is rotatable in a rotary degree of freedom and said rotational force provides a force to said drive bar in said rotary degree of freedom of said drive bar.

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28 ~~102.~~ (amended) A method as recited in claim 27 ~~101~~ further comprising frictionally engaging said drive bar with [a] at least one passive roller on an opposite side of said drive bar to said drive roller, where said at least one passive roller is biased toward said drive roller to create a clamping force on said drive bar.

103. A method as recited in claim 101 wherein said drive bar is rigid.

30 ~~104.~~ (amended) A method as recited in claim 27 ~~101~~ further comprising rotating said drive bar and a member coupled between said drive bar and said user manipulatable object, said [translation] rotation caused by said rotational force.

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105. A method as recited in claim 101 further comprising translating said drive bar and a member coupled between said drive bar and said user manipulatable object, said translation caused by said rotational force.

Please add the following claims:

15 ~~106.~~ (new) A friction drive mechanism as recited in claim 13 ~~88~~ wherein said passive roller is a first passive roller, and further comprising a second passive roller frictionally engaged with said drive bar on said opposite side of said drive bar to said drive roller.

23 ~~107.~~ (new) A friction drive mechanism as recited in claim 22 ~~88~~ wherein said drive roller is coupled to one of said first and second passive rollers by a rigid member, and wherein said other of said first and second passive rollers is spring biased toward said drive roller to create said clamping force.

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25 ~~108.~~ (new) A friction drive mechanism as recited in claim 24 ~~99~~ wherein said passive roller is a first passive roller, and further comprising a second passive roller frictionally engaged with said drive bar, wherein said passive rollers are coupled to each other and to said drive roller by non-tensile connections.

32 ~~109.~~ (new) A method as recited in claim 27 ~~101~~ further comprising frictionally engaging said drive bar with at least one passive roller on an opposite side of said drive bar to said drive roller, where said at least one passive roller is coupled to said drive roller by a non-tensile connection.